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TRANSLATION (BU-07PCT):

Translated Text of WO 2004/037,584 A1 (PCT/DE2003/003,368) with Amended Claims Incorporated Therein

CONVERTIBLE

The invention concerns a convertible with a roof that comprises at least one rigid rear roof part in accordance with the introductory clause of Claim 1 and a convertible in accordance with the introductory clause of Claim 12.

FR 2 693 956 describes a convertible with two rigid roof parts, one of which is a rear roof part that encloses a rear window, while the other is a front roof part that is essentially horizontal when the roof is closed. The two roof parts can be moved into the automobile body in different lowered positions in such a way that a landau top is obtained by lowering only the rear roof part, a targa top is obtained by lowering only the front roof part, and a full convertible is obtained by lowering both roof parts. However, in its lowered position, the front roof part protrudes upward over the belt line of the automobile body and thus obstructs the view to the rear. Furthermore, this adversely affects the air resistance and the visual appearance of the vehicle. In addition, the airflow causes large forces to

act on a roof part mounted in this way, which promotes wear of the mechanical mechanisms of the roof.

The invention is based on the problem of creating a convertible that allows a high degree of useful flexibility of the roof opening.

The invention solves this problem with a convertible with the features of Claim 1 and with a convertible with the features of Claim 12. Advantageous modifications of the invention are specified in dependent Claims 2 to 11 and 13.

In accordance with the invention, the extent of the lowered front roof section is reduced in at least one direction perpendicular to its transverse extent. This results in favorable stowed dimensions of the lowered roof parts, so that, for example, in the case of essentially vertical lowering of these roof parts, they can be held below the belt line of the automobile body. The thickness of the lowered front roof section is also small due to this nesting of the roof parts.

The essentially vertical lowering of the roof parts causes minimal restriction of the longitudinal extent of a luggage compartment adjacent to the stowing section of the roof and is therefore especially advantageous.

If the front roof parts can be moved independently of the

rear roof part, the flexibility of the roof opening is increased. It is possible, for example, to select as the driving position not only a full convertible position with all of the roof parts lowered, but also a targa position with the roof parts of the front roof section lowered.

If the front roof section comprises exactly two roof parts, and the first roof part can be moved over the second roof part to achieve partial opening, then it is also possible to open just the first roof part, so that a sort of sunroof function is obtained, which further increases the flexibility of the roof opening.

The invention can be used both in vehicles with exclusively rigid roof parts and in vehicles in which the front roof section forms a textile-based frame construction.

If a convertible with several individually movable roof parts is provided with a computer program that allows a desired roof position to be input and then determines the current state of the roof position and a route by which the desired roof position can be achieved, then the operator does not have to give a thought to how he will go about changing the roof parts from their current position to their desired position without causing obstruction of the roof movement or damage of the roof

parts.

The program advantageously determines the fastest route from the current state to the preselected desired state and automatically controls the necessary drives.

Other advantages and features of the invention are apparent from the specific embodiment of the object of the invention that is illustrated in the drawings and described below.

-- Figure 1 shows a convertible of the invention in a schematic side view that is broken off below and at the front, with the roof closed

-- Figure 2 shows a view similar to that of Figure 1 during the movement of the roof parts of the front roof section one over the other with simultaneous opening of a rear cover of the folding-top compartment for initiating the opening of all of the roof parts.

-- Figure 3 shows a view similar to that of Figure 2 with the roof parts of the front roof section moved one over the other and with the cover of the folding-top compartment completely opened.

-- Figure 4 shows a view similar to that of Figure 3 during the opening movement of the rear roof part.

-- Figure 5 shows a view similar to that of Figure 4 during

the lowering movement of the roof parts of the front roof section.

-- Figure 6 shows a view similar to that of Figure 5 with the roof parts of the front roof section completely lowered.

-- Figure 7 shows the final position of the convertible with the roof completely open.

-- Figure 8 shows a view similar to that of Figure 7 with the rear roof part raised to create an opening for the passage of the roof parts of the front roof section.

-- Figure 9 shows a continuation of the sequence of movements according to Figure 8 with the roof parts of the front roof section completely closed and with the rear roof part completely open to form a landau position of the roof.

-- Figure 10 shows a section along line X-X in Figure 1.

Figure 1 shows a schematic representation of a two-seat convertible 1. A convertible with a larger number of seats is also possible in accordance with the invention.

The vehicle 1 comprises a movable roof, which is labeled as a whole with 2. The roof 2 comprises a rear roof part 3, i.e., a roof part that is located at the rear relative to the direction of travel F, with a flexible or, especially, rigid rear window 4, which can be made, for example, of plastic or,

advantageously, glass. In this embodiment, the rear roof part 3 is constructed as a rigid roof part and consists, for example, of steel, a light metal, a metallic foam material, or plastic. It is also possible for the rear roof part 3 to be formed essentially only of a rear window 4 that is curved like an arch.

In addition, the roof 2 comprises a front roof section 5, which, in the closed state, is arranged in front of the rear roof part 3 in the direction of travel F of the vehicle. The front roof section 5 contains at least two (in the illustrated embodiment, exactly two) roof parts 6, 7, which lie one behind the other when the roof is closed and are movable relative to each other and relative to the body 8 of the convertible 1. When the roof is closed, the front roof part 6 is supported on the windshield frame, and the roof parts 6, 7 are flush with each other. The roof parts 6, 7 can be designed either as rigid parts or as units covered with a textile material.

To allow the roof parts 6, 7 to be moved, they are connected with each other by a four-bar linkage 9 in such a way that the front roof part 6 can be displaced essentially parallel over the roof part 7 behind it (Figure 2, Figure 3). In addition, the roof parts 6, 7 are connected with the automobile body 8 and can be moved into and out of it by means of lateral

swivel arms 10, 11, which can be swiveled towards the rear about bearings 12, 13 that are fixed with respect to the automobile body.

The rear roof part 3 is connected with the automobile body 8 by a multijoint linkage 14, which comprises two links 17, 18 that can be swiveled towards the rear about pivot joints 15, 16, which are fixed with respect to the automobile body and have horizontal pivot axes. The rear link 18 with respect to the direction of travel F can be moved only indirectly about the pivot joint 16, which is fixed with respect to the automobile body, and is connected by an intermediate link 16a, which acts on the link 18 at the joint 18a. The intermediate link 16a is supported approximately in the middle on joint 16, and the end of the intermediate link 16a that is located at the opposite end from the link 18 is operatively connected with another intermediate link 16c by means of a joint 16b. Intermediate link 16c acts on the link 17 by means of the movable pivot joint 17a. In this way, the movements of the links 17 and 18 are coupled by means of the intermediate linkage 16a, 16c.

In regard to the front roof section 5, the bearings 12, 13, which are fixed with respect to the automobile body, are arranged essentially vertically one above the other. As a

result, the swivel arms 10, 11, which lie parallel face to face in the closed position of the roof 2, open relative to each other during the swiveling movement (transition from Figure 4 to Figure 5). Nevertheless, it is desirable to be able to ensure a common covering of the two swivel arms when the roof 2 is closed in order to improve the visual appearance of the interior and prevent the risk of injury. For this purpose, a two-part covering 26 (Figure 10) is provided, which is divided at a separating line 27 parallel to the course of the swivel arms 10, 11. One part 28 of the covering 26 is arranged on the more inner swivel arm 11, and the other part 29 is arranged on the swivel arm 10. When the two swivel arms 10, 11 move apart during the opening of the roof , the covering parts 28, 29 can follow the respective swivel arms and yet ensure uniform covering when the roof 2 is in its closed position. In particular, a marginal projection 30 of one of the parts 28, 29 of the covering can overlap the separating line 27, which is then invisible when the roof is closed.

Both the front roof section 5 and the rear roof part 3 can be lowered inside the automobile body 8 below the belt line 19 independently of each other by means of the swivel arms 10, 11 and the links 17, 18, respectively.

In the illustrated embodiment, a folding-top compartment is located in the rear end of the automobile body 8. It has a cover 20, which is arranged approximately in the plane of the belt line 19 and swings open in the direction of arrow 21.

To open the roof 2 from its closed position (Figure 1) to a completely opened full convertible position (Figure 7), the front roof part 6 is first released from the windshield frame and moved over the roof part 7 located behind it (Figure 2, Figure 3). At the same time, the cover 20 of the folding-top compartment opens behind the rear roof part 3 to enlarge an opening for the passage of the roof 2.

In the position shown in Figure 3, the front roof parts 6, 7 have been moved completely parallel one above the other by means of the four-bar linkage 9. A textile covering that may be present is raised from the rear roof part 7 of the front roof section 5 to provide sufficient clearance for the illustrated movement of the roof parts 6, 7. Due to the upwardly sloping shape of the roof parts 6, 7 relative to the longitudinal center plane of the vehicle, the front roof part 6 can overarch the more rearward roof part 7, so that the latter is held in the arch of the roof part 6, and a nested stack of roof parts 6, 7 is formed. This stack has a very small depth. It should also

be noted that the cover 20 of the folding-top compartment is completely open in the position shown in Figure 4.

The rear roof part 3 can then swivel by means of the links 17, 18 about the joints 15, 16 in the direction of arrow 22 and thus arrive in an almost vertical position (Figure 4), in which a large region for the passage of the front roof parts 6, 7 is created in front of the roof part 3 that has been stood up in this way.

The front roof parts 6, 7 can then swivel downward by means of the swivel arms 10, 11 in the direction of movement 23 (Figure 5) and finally arrive in the nearly vertical position inside the automobile body 8 that is illustrated in Figure 6.

Upon further opening of the multijoint linkage 14 in the direction of arrow 22a, the rear roof part 3 can then swivel in the opposite direction of rotation (arrow 24) to arrive in a nearly horizontal position, in which it partially covers the space for the passage of the roof 2 through the plane of the belt line 19 and overlaps the stack of roof parts 6, 7, which has only a small height here. The invention thus makes it possible not only to hold the front roof section completely inside the automobile body 8 but also to reduce the dimension of the lowered roof 2 in the longitudinal direction of the vehicle,

since the rear roof part no longer has to lie completely behind the lowered front roof section 5 but rather at least partly overlaps the front roof section 5. In addition, the nested stack comprising roof parts 6, 7 has a very small dimension in the longitudinal direction of the vehicle.

In the full convertible position shown in Figure 7, the cover 20 of the folding-top compartment can also close back down over the rear roof part 3 that has been lowered in this way, so that a harmonious side line is obtained.

Alternatively, it is possible to have an embodiment in which the roof parts 6, 7 in their nested position are lowered horizontally beneath the rear roof part 3. In this case, in the final position of the lowered roof parts 6, 7, the curvature of the roof part 3 that closes over them would be in the same direction as the curvature of the stack of front roof parts 6, 7, so that, all together, the space requirement of the lowered roof 2 would also be small in this embodiment.

Figures 8 and 9 show drawings of other suitable driving positions of the roof of the convertible vehicle 1.

In Figure 8, the roof parts 6, 7 of the front roof section 5 are completely lowered, while the rear roof part 3 is raised in the same position it occupies when the roof is closed, so

that a targa vehicle is obtained. Rear quarter windows 25 that may be present can be closed in this position to help stabilize the rear roof part 3. Since the position of the rear roof part 3 corresponds to the closed position shown in Figure 1, the cover 20 of the folding-top compartment can also be closed again. The targa position can be set directly from the position of the roof parts that is shown in Figure 6 by swiveling the roof part 3 forward. It is also possible to set the roof to this position from the completely closed position of the roof (Figure 1) or from the completely open position of the roof (Figure 7).

Program logic can be provided, which allows the operator to preset the desired position of the roof and then automatically determines the current state of the roof and the most suitable route to the desired position. For this purpose, the various roof opening states can be visually shown on the dashboard, for example, in the form of separate operating buttons for the various roof states or in the form of a screen display. The desired roof position can then be automatically set by clicking on the desired position or by other means of operation.

In Figure 9, the rear roof part 3 is lowered into the automobile body 8, while the front roof parts 6, 7 are in their closed position above the passenger compartment, so that a so-

called landau position is obtained, in which, for example, a front row of seats is covered by the roof, and a rear row of seats is not covered by roof sections, or, in the case of a vehicle with only one row of seats, ventilation and sunshine can be admitted obliquely from the rear. The position shown in Figure 9 can be set directly from the closed position that is shown in Figure 1 by moving the rear roof part 3 in the opening direction, while the front roof parts 6, 7 are kept in the closed position.

At least four different roof positions -- completely open, completely closed, targa position, and landau position -- can thus be realized in the convertible 1 of the invention. Provision can also be made for the position in which the front roof parts 6, 7 are displaced one above the other (Figure 4) to be used as a driving position, in which case the front roof part 6 would be opened like a sunroof but over the entire width of the roof. Especially with the side windows lowered, a wide-open outdoor feeling would be produced, even with the rear roof part 3 closed.